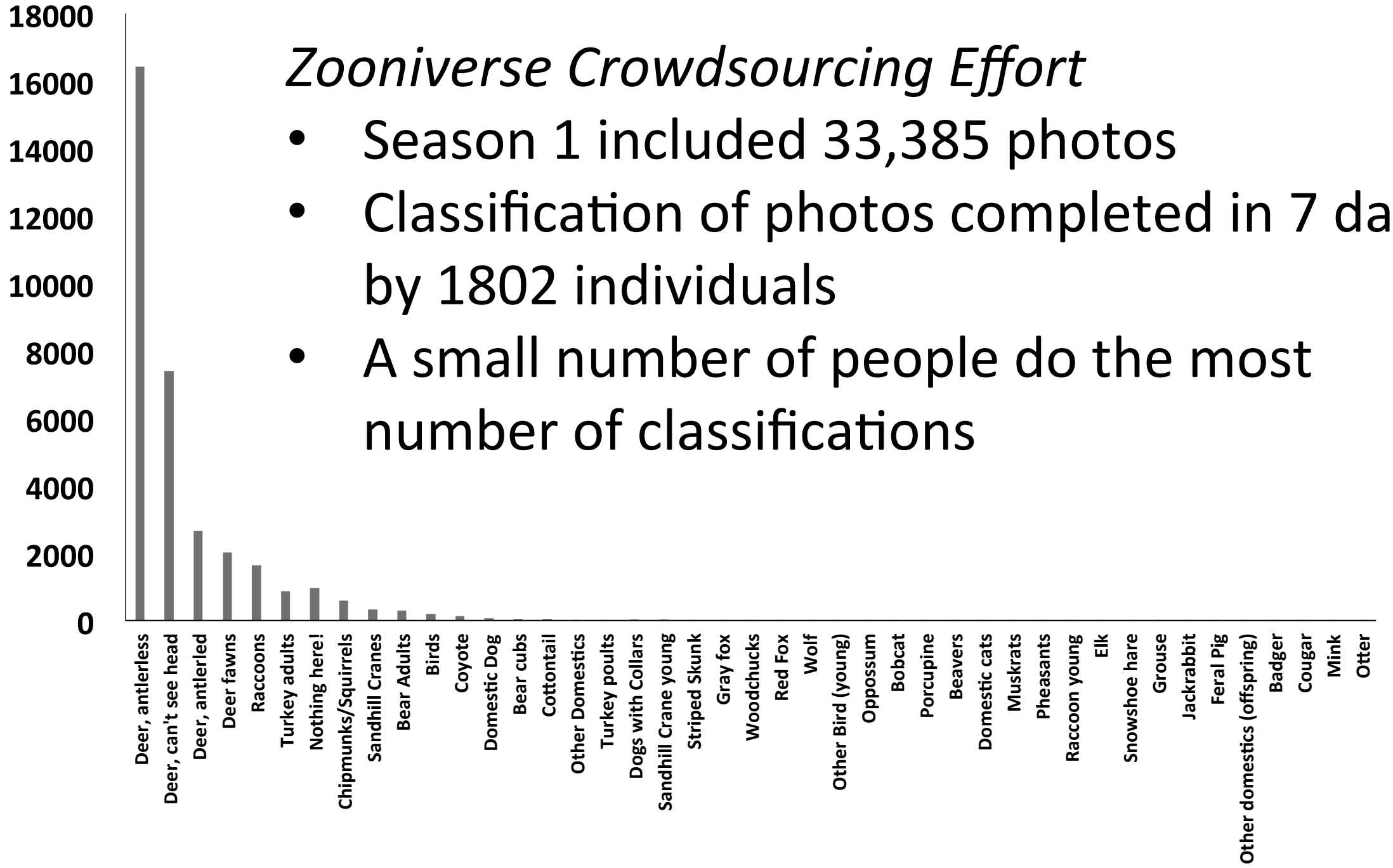
SNAPSHOT WISCONSIN

Can we predict animal presence and abundance statewide using remote sensing and trail cameras?

- Partner Agency
- Citizen Science / Crowdsourcing
- Remote Sensing
- Predictive Modeling
- Resource Management Objective
- Application Implementation



Zooniverse Crowdsourcing Effort

- Season 1 included 33,385 photos
- Classification of photos completed in 7 days by 1802 individuals
- A small number of people do the most number of classifications

Modeling Animals as a Function of Remote Sensing

ψ Probability of occurrence

p Probability of detection

λ Expected abundance

John Clare (Ph.D. Student), Ben Zuckerburg, Tim van Deelen, Phil Townsend, *UW-Madison*
Jen Stenglein, *Wisconsin DNR*

Occurrence/Distribution

$z_i \sim \text{Bernoulli}(\psi_i)$

A site is occupied w/ some probability

$\text{Logit}(\psi_i) = \beta_0 + \beta_1 X_i$

This probability changes with environmental conditions

$\text{Logit}(p_{ij}) = \beta_0 + \beta_1 X_{ij}$

If occupied, we observe the species with some probability that may vary over time or space

$y_{ij} \sim \text{Bernoulli}(p_{ij} \times z_i)$

Our repeated presence-absence observations reflect the product of these distinct probabilities

Abundance

$N_i \sim \text{Poisson}(\lambda_i)$

Abundance at a site is a realization from an expected mean

$\text{Log}(\lambda_i) = \beta_0 + \beta_1 X_i$

Expected abundance varies across space

$\text{Logit}(r_{ij}) = \beta_0 + \beta_1 X_{ij}$

Each individual animal has some probability of being observed that may vary over time of space

$p_{ij} = 1-(1-r_{ij})^{N\downarrow i}$

The probability of observing the species at a specific time is proportional to individual detection and the number of individuals

$y_{ij} \sim \text{Bernoulli}(p_{ij})$

Repeated presence-absence reflects abundance and individual detection

Ongoing Work

Incorporate additional uncertainty

- MODIS Land Cover Dynamics
- Additional Landscape Metrics

Incorporate dynamics

Explicitly consider spatial demographic processes

Application by Wisconsin DNR

Social Science

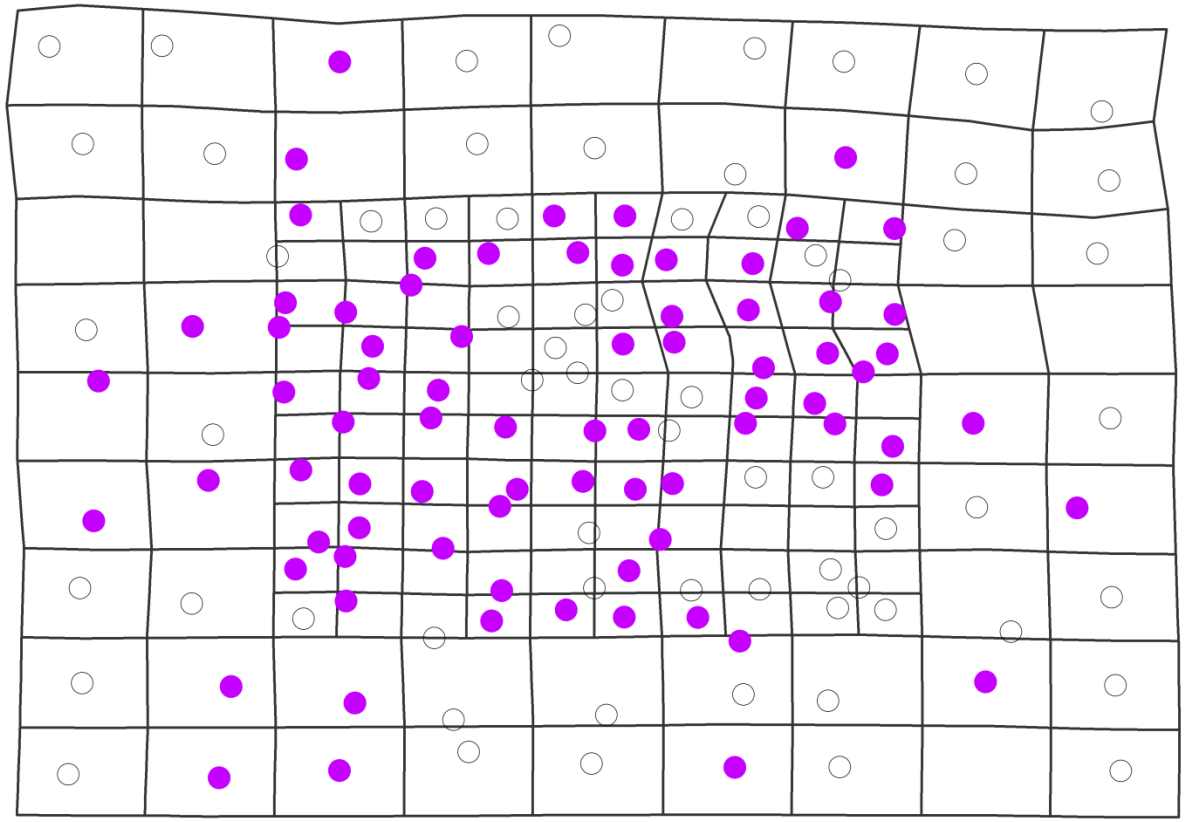
Camera sites with elk

Distribution Maps

Seen

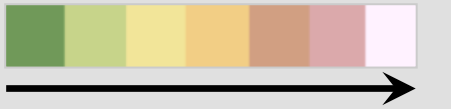
Not seen

at 144 cameras active
10 – 206 days between
Jan 2015 and Feb 2016



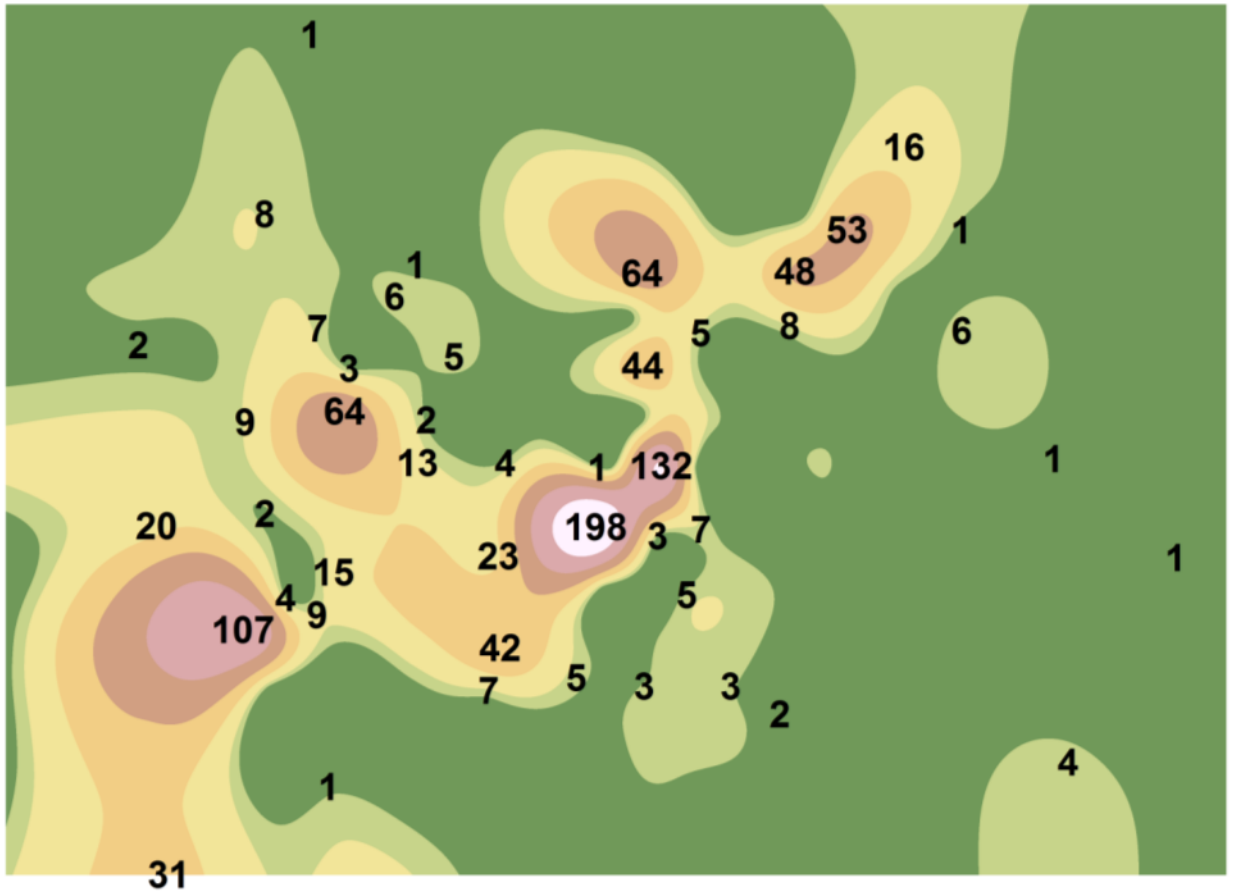
Sighting density of elk

Sighting Density Maps



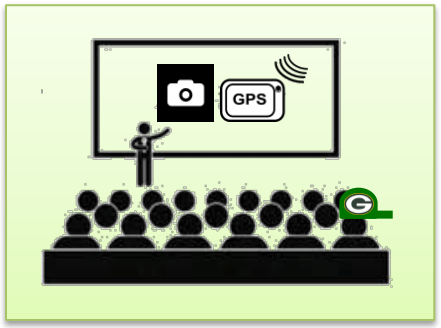
Low to high relative sighting density

Numbers are nonzero counts of individuals at 96 cameras active July 17 – Oct 5, 2015

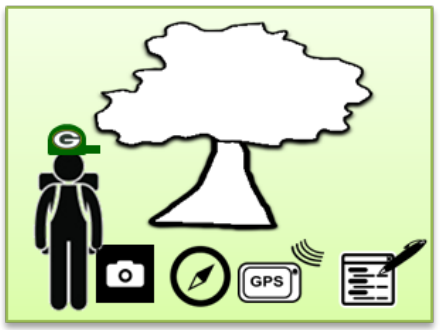


Citizen Science: Two ways to participate

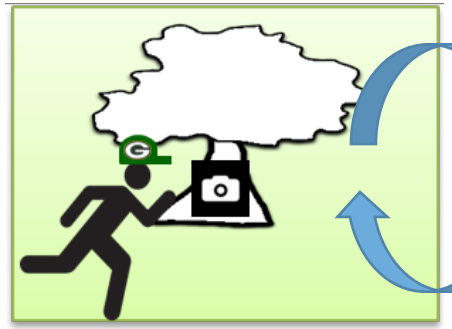
1. Host a trail camera within a survey block



Attend training

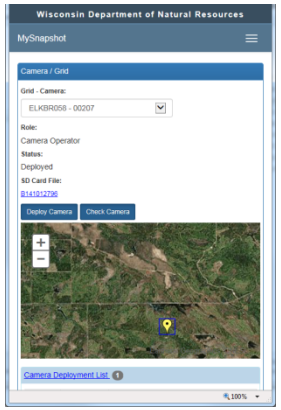


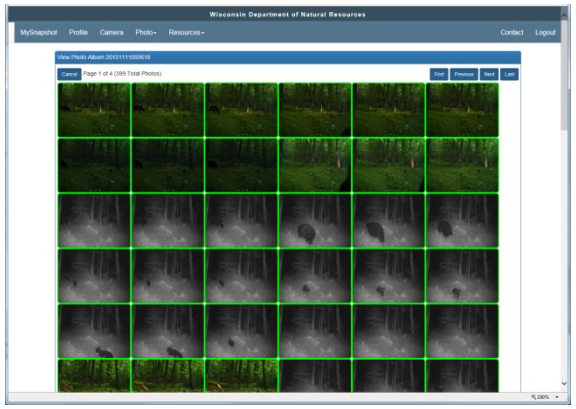
Set up a camera



Retrieve photos

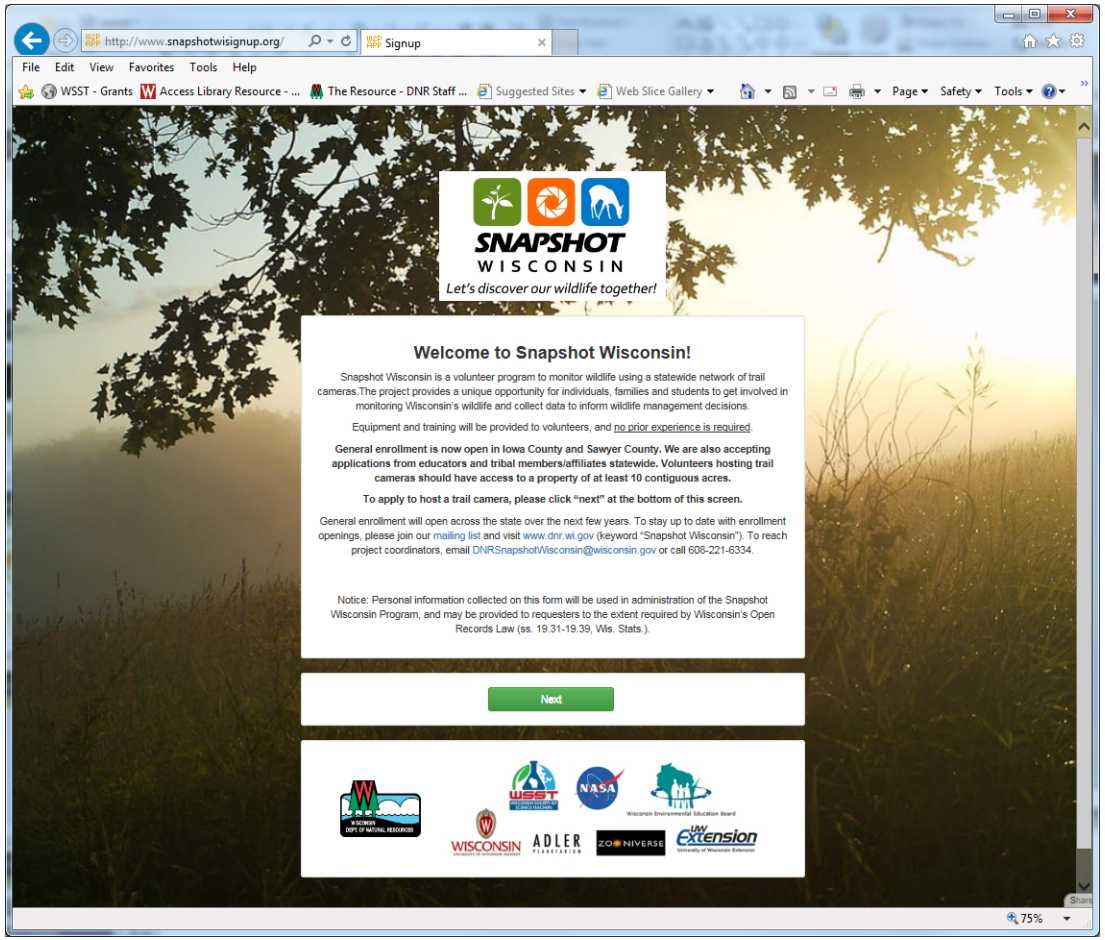
Upload & check photos

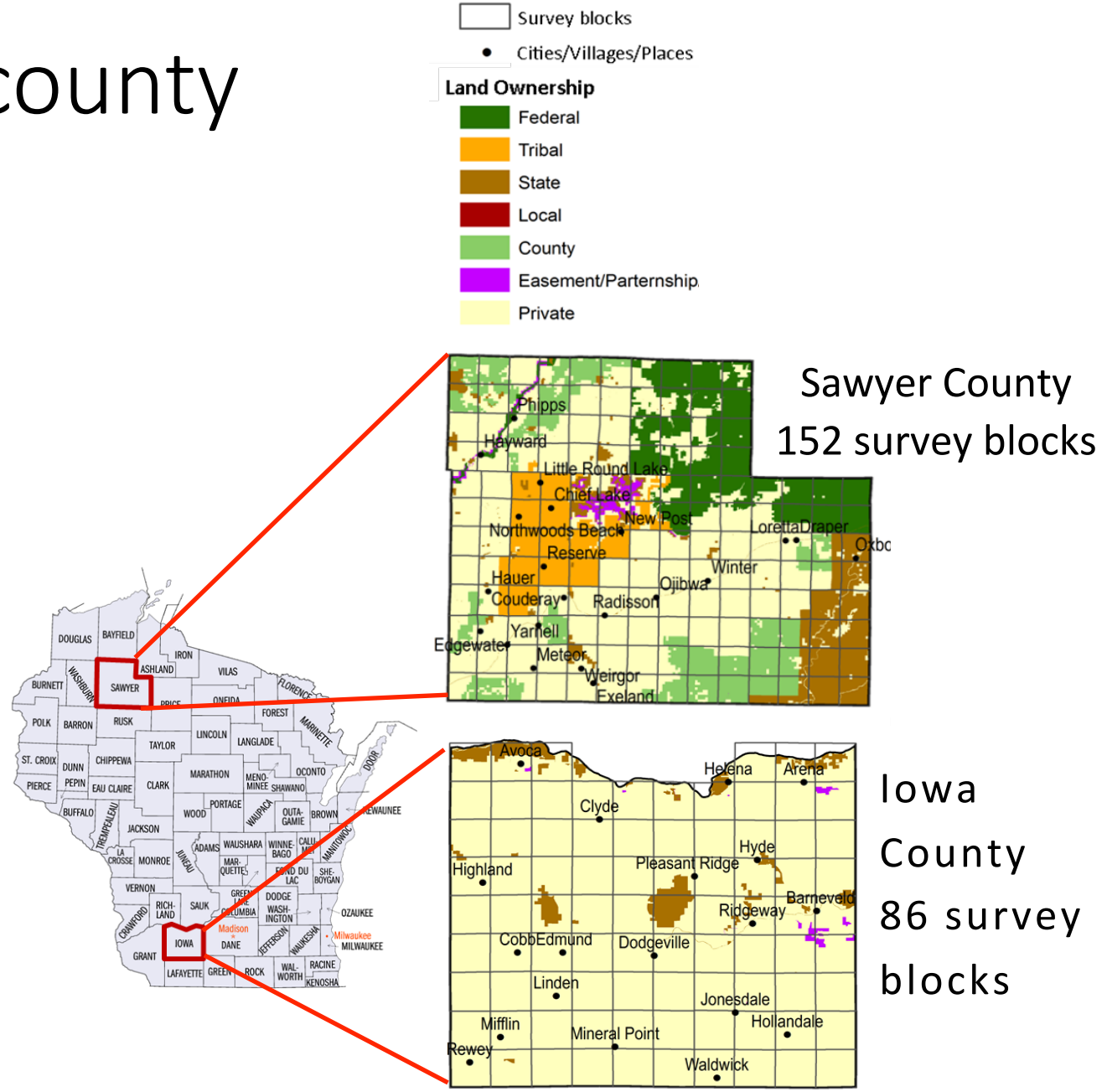




Enrolling volunteers by county

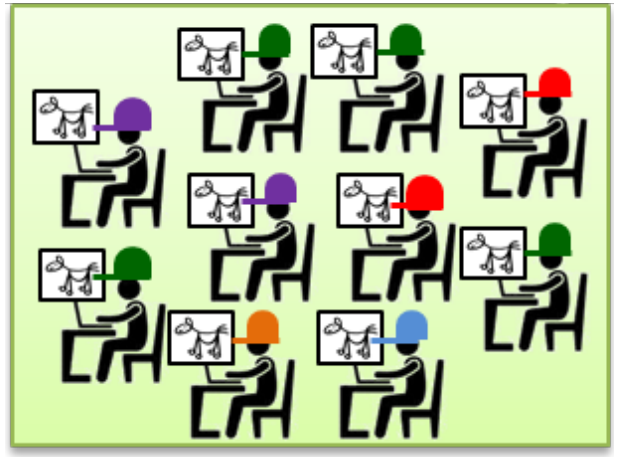
SnapshotWIsignup.org



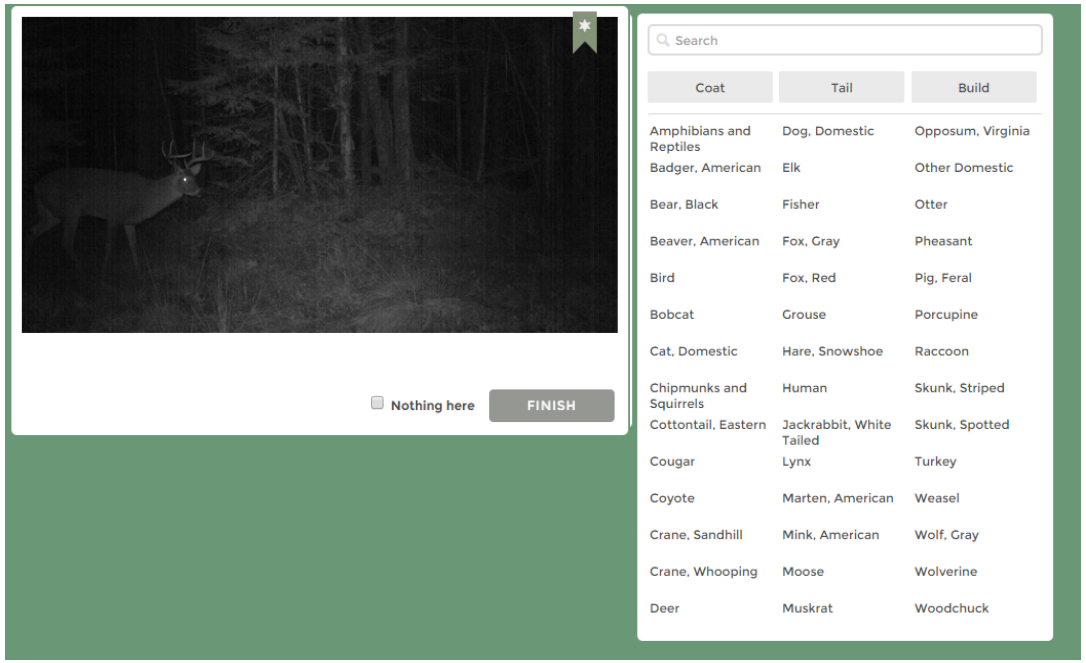


Citizen Science: Two ways to participate

2. Classify animals in photos

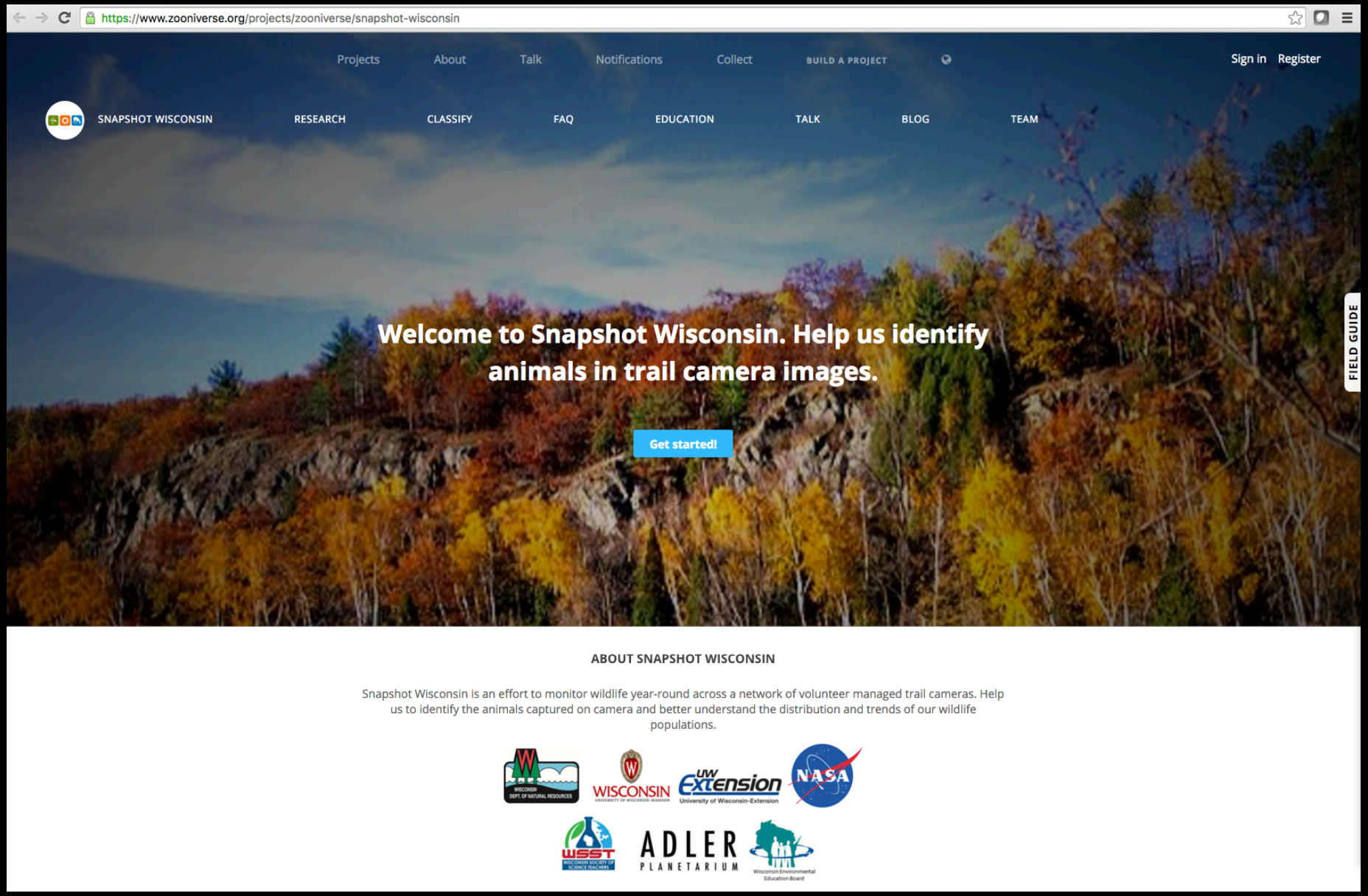


ZOONIVERSE



Laura Trouille (Adler Planetarium), many others

www.snapshotwi.org Live Now! Press and Media Blitz on May 17



Looks Like	Body Size	Rare/Uncommon
Amphibians and Reptiles	Fisher	Pig, Feral
Badger	Fox, Gray	Porcupine
Bear	Fox, Red	Raccoon
Beaver	Grouse	Skunk, Spotted
Other Bird	Jackrabbit	Skunk, Striped
Bobcat	Lynx	Snowshoe Hare
Cat, Domestic	Marten	Squirrels and Chipmunks
Cottontail	Mink	Turkey
Cougar	Moose	Weasel
Coyote	Muskrat	Wolf
Crane, Sandhill	Opossum	Wolverine
Crane, Whooping	Other Domestic	Woodchuck
Deer	Other Rodent	Nothing here
Dog, Domestic	Otter	Human
Elk	Pheasant	

Showing 44 of 44. Clear filters

FIELD GUIDE

Done

Show the project tutorial

Building an online community

7558 comments in 4934 posts to date

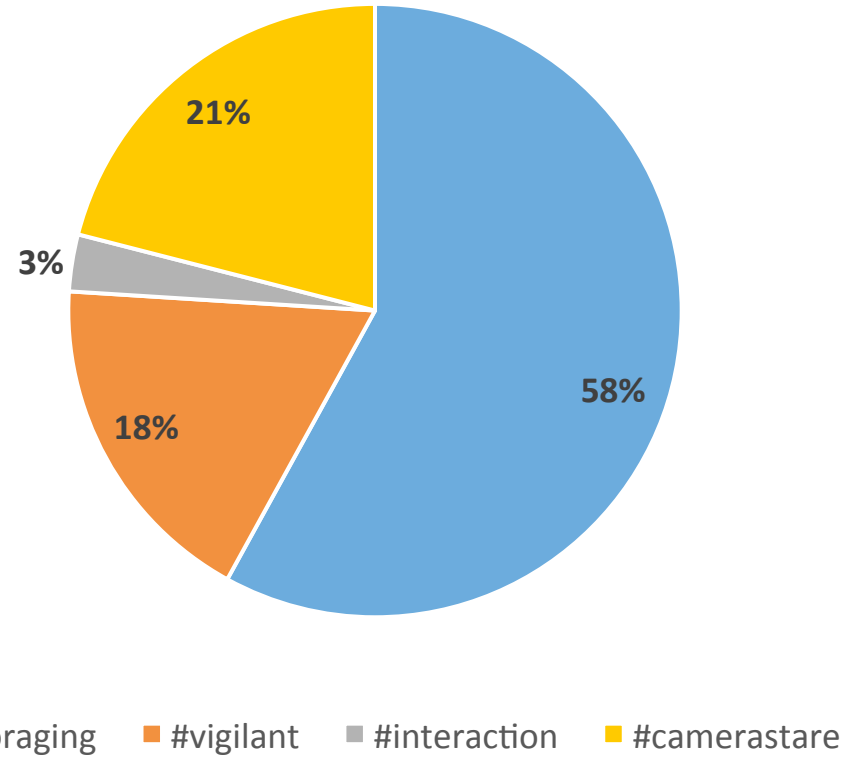
Talk boards are motivational to participants, but also provide us with a wealth of information

- Qualitative data on which species are difficult for individuals to identify
- Source of opportunistic data

- Social Science Research: Public Engagement in Science

Christine Anhalt-Depies (Ph.D. Student), *UW-Madison*

Volunteer Hashtags



Objectives:

Education Attitudes Engagement Community Involvement Build relationships

Human/vehicle detection

Remove identifiable humans/vehicles

Current version: Color based

Next version: optical flow + segmentation + ML (under development)